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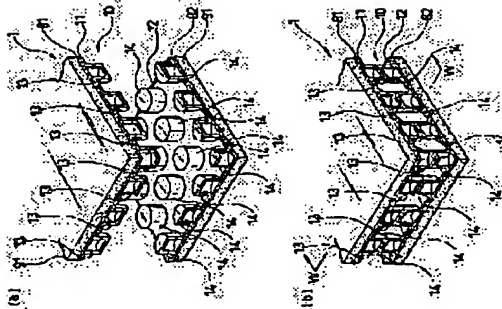
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## (54) HONEYCOMB STRUCTURAL PLATE

(57)Abstract:

**PROBLEM TO BE SOLVED:** To provide a honeycomb structural plate wherein its rigidity is improved without increasing the wt. and in addition, shock absorbing properties, sound absorbing properties, etc. are excellent.

**SOLUTION:** An intermediate member 10 prep. by forming a plurality of hollow projected bodies 13 and 14 on each of a plurality of thin sheets 11 and 12 and bringing projected parts of the hollow projected bodies 13 and 14 formed on each of the thin sheets 11 and 12 into contact with each other, bonding members 81 and 82 provided on one face or both faces of this intermediate member 10 and small rooms (airtight rooms) formed in the hollow projected bodies 13 and 14 by providing these bonding members 81 and 82, are provided.



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**CLAIMS****[Claim(s)]**

[Claim 1] The honeycomb structure plate characterized by having the pars intermedia material to which the heights of the hollow convex object which formed two or more hollow convex objects in each of two or more sheet metal, and was formed in said each sheet metal are made to come to contact mutually, the attachment member with which one field or both sides of this pars intermedia material are equipped, and the areole formed in the interior of said hollow convex object of the equipment of this attachment member.

[Claim 2] The honeycomb structure plate according to claim 1 characterized by making only some hollow convex objects contact mutually among two or more hollow convex objects formed in each of two or more of said sheet metal.

[Claim 3] The honeycomb structure plate according to claim 1 or 2 characterized by for while forming in said each sheet metal, and the dimension of a hollow convex object, a configuration, or its both differing from the hollow convex object of another side in it.

[Claim 4] The honeycomb structure plate characterized by equipping with the epidermis material which is the honeycomb structure plate of any one publication of claim 1 to claim 3 which equipped one field of said pars intermedia material with the attachment member, and has permeability in the field of another side of said pars intermedia material.

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## DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention is amelioration of the conventional honeycomb structure plate, and it relates to the honeycomb structure plate which can raise the rigidity, without raising weight.

[0002]

[Description of the Prior Art] As a conventional honeycomb structure plate, there is a technique indicated by JP,7-37629,U and JP,10-156985,A. The conventional honeycomb structure plate indicated by these official reports is a plastics structural panel which consists of thermoplastics or its constituent, and the use range is various and finds interiors, such as interiors, such as an automobile, and a house, etc. useful from high intensity, high rigidity, and the special feature of being lightweight. The typical example of structure of this honeycomb structure plate (henceforth the conventional structural panel) is explained referring to a drawing. Incidentally, drawing 10 is the perspective view of the conventional structural panel, (a) shows assembly before and (b) shows the assembly back. Moreover, drawing 11 R> 1 is the Z-Z sectional view of drawing 10 (b).

[0003] Said conventional structural panel 100 is equipped with two or more hollow convex objects 101 and the pars intermedia material 102 which has .. like drawing 10 . And the attachment member 103,103 is stuck and stuck to both sides of this pars intermedia material 102, and the epidermis material 105,105 which consists of minerals etc. is further stuck and stuck to the external surface of each of this attachment member 103,103.

[0004] The internal structure of the conventional structural panel 100 is formed like drawing 11 . Crevice 101b which carried out opening of the end, and .. are formed in the hollow convex object 101 in the pars intermedia material 102, and the interior of .. and the attachment member 103,103 — sticking — mainly — this crevice 101b and .. a sealed cabin 108 and .. are formed inside. External force absorptivity, such as compressive strength, adiabatic, etc. improve by formation of this sealed cabin 108 and ..

[0005] The pars intermedia material 102 and the attachment member 103 consist of thermoplastics or its constituent, and each other are stuck using adhesion material or hardenability adhesives. Although the pars intermedia material 102 is manufactured by various well-known approaches, such as a vacuum forming and injection molding, it outlines the manufacture for the case of a vacuum forming for an example.

[0006] Drawing 12 is the mimetic diagram of vacuum-forming equipment 110. The members shown with a sign 106 are the hollow convex object 101 and the roll section which forms .., and have the hollow convex object 101 and the mold section corresponding to .. in a peripheral surface. The sheet 107 which consists of thermoplastics etc. is sent in in the roll section 106 through T die 111. Then, the hollow convex object 101 and .. are formed in a sheet 107 of heating suction, and it becomes the pars intermedia material 102 by it. This pars intermedia material 102 is sent out by rotation of the roll section 106. Moreover, while being sent out, the attachment member 103,103 and the epidermis material 105,105 stick, and are stuck by this pars intermedia material 102, and the conventional structural panel 100 is completed to it. In addition,

sending of the attachment member 103 and epidermis material 105 grade is performed through T die 109,109.

[0007]

[Problem(s) to be Solved by the Invention] By the way, the conventional structural panel 100 had the following problems. When the pars intermedia material 102 consists of thermoplastics or its constituent, the means of the above mentioned vacuum-forming approach is usually used well. It improves [ spacing between the epidermis material 105,105 and the volume of areole (sealed cabin) 108 grade become large, and / external force absorptivity, adiabatic, etc. ] and is suitable if the height of the hollow convex object 101 in the pars intermedia material 102 is high. [0008] When the height of the hollow convex object 101 is too high, the hollow convex object 101 and the wall of .. film-ize, and it becomes impossible however, to maintain reinforcement for example, when manufacturing the pars intermedia material 102 by said vacuum-forming method. In order to prevent this un-arranging, when the wall of the pars intermedia material 102 is made thick, weight increases and it becomes impossible on the other hand, to attain lightweight-ization which is the advantage of honeycomb structure plate original. That is, there were also many problems on the reinforcement in the manufacture of the pars intermedia material 102 for which about 5mm is a limitation and the height of the hollow convex object 101 needs a large area especially in said conventional structural panel 100.

[0009] In addition, such a problem may have produced the same problem, not only when making said thermoplastics etc. into the quality of the material but when a honeycomb structure plate was manufactured from other quality of the materials. Without making to solve said each problem into the technical problem, and raising weight, this invention raises the rigidity and aims at offering the honeycomb structure plate which is further excellent in impact absorptivity, absorption-of-sound nature, etc.

[0010]

[Means for Solving the Problem] The pars intermedia material to which the heights of the hollow convex object which this invention formed two or more hollow convex objects in each of two or more sheet metal, and was formed in said each sheet metal in order to attain the above technical problem are made to come to contact mutually. It considered as the honeycomb structure plate characterized by having the attachment member with which one field or both sides of this pars intermedia material are equipped, and the areole formed in the interior of said hollow convex object of the equipment of this attachment member. According to the above means, rigidity, impact absorptivity, a heat insulation operation, etc. can be raised, without making the weight of a honeycomb structure object increase. In addition, areole may have permeability like the case where it is the sealed cabin which has airtightness like the gestalt of the 6th operation from the 1st, and the gestalt of the 7th operation. For example, in the case of the former, it can realize by giving airtightness to an attachment member, and, in the case of the latter, can realize by giving permeability to an attachment member.

[0011] Moreover, it can also consider as the honeycomb structure plate characterized by making only some hollow convex objects contact mutually among two or more hollow convex objects formed in each of two or more of said sheet metal. According to this means, only when other hollow convex objects deform the hollow convex object which does not participate in contact, it will interfere, and effective strengthening of much more lightweight-izing and rigidity, and impact absorptivity can be attained.

[0012] Furthermore, it can also consider as the honeycomb structure plate characterized by for while forming in said each sheet metal, and the dimension of a hollow convex object, a configuration, or its both differing from the hollow convex object of another side in it. According to this means, rigid strengthening becomes easy to transform the hollow convex object which contacts each other from the first, and impact absorption increases.

[0013] Furthermore, it is the honeycomb structure plate according to claim 1 which equipped one field of said pars intermedia material with the attachment member, and can also consider as the honeycomb structure plate characterized by equipping with the epidermis material which has permeability in the field of another side of said pars intermedia material. According to this means, the absorption-of-sound effectiveness from the field of the epidermis material which has

permeability increases, with rigidity, a heat insulation operation collateralized, etc.

[0014]

[Embodiment of the Invention] This invention is concretely explained based on the gestalt of operation, referring to a drawing suitably. Drawing 1 is the perspective view of the honeycomb structure plate concerning the gestalt of the 1st operation, and the condition that (a) made the sheet metal of pars intermedia material estrange, and (b) are in the condition which the sheet metal of pars intermedia material was made to contact. Moreover, drawing 2 (a) is the W-W sectional view of drawing 1 (b), and drawing 2 (b) is the gestalt of the 3rd operation corresponding to [are the gestalt of the 2nd operation and ] the W-W sectional view of drawing 1 (b) in drawing 2 (c) corresponding to the W-W sectional view of drawing 1 (b).

[0015] With the honeycomb structure plate 1 concerning the gestalt of the 1st operation, the pars intermedia material 10 consists of sheet metal 11 and 12 of two upper and lower sides like drawing 1. Two or more hollow convex objects 13, ... 14 which correspond each other like drawing 2 (a), and .. are formed in each of this sheet metal 11 and 12, and each hollow convex objects 13, ... 14, the heights 13a, ... 14a of ... and .. contact uniformly, and it is stuck and united, and is united. In addition, with the gestalt of this operation, the hollow convex object 13 and .. which are formed in sheet metal 11 are equivalent to one hollow convex object, and the hollow convex object 14 and .. which are formed in sheet metal 12 are equivalent to the hollow convex object of another side.

[0016] One hollow convex object 13, .. and the hollow convex object 14 of another side, and .. are explained in full detail. In addition, one hollow convex object 13 and .. are the same configurations, respectively, and the hollow convex object 14 of another side and .. are also the same configurations, respectively. Therefore, in the following explanation, the hollow convex objects 13 and 14 of a lot which correspond mutually are explained, in addition the explanation about two or more hollow convex objects 13, ... 14 and .. is omitted. Moreover, except for the case where the gestalt of the 6th operation also adds especially explanation, two or more formation of while was carried out from the 2nd mentioned later, and a hollow convex object and the hollow convex object of another side are the same configurations, respectively. Therefore, only the hollow convex object of a lot which corresponds mutually is explained, and explanation of other hollow convex objects is omitted.

[0017] While was formed in sheet metal 11, a skin serves as the shape of a cylindrical shape nothing (refer to drawing 1 ), and, as for the hollow convex object 14 of another side formed in the hollow convex object 13 and sheet metal 12, this skin serves as Heights 13a and 14a, respectively. On the other hand, the internal surface of the hollow in which the end face carried out opening is formed in the interior of these hollow convex objects 13 and 14, and this internal surface is equivalent to Crevices 13b and 14b. As for each hollow convex objects 13 and 14, the formation location corresponds mutually, and each bases 13c and 14c of Heights 13a and 14a contact. Furthermore, in the gestalt of this operation, the contact part of each bases 13c and 14c has fixed in modes, such as adhesion or welding. Consequently, each sheet metal 11 and 12 is united, and forms the pars intermedia material 10.

[0018] the attachment members 81 and 82 which have airtightness in both sides of the upper and lower sides of the pars intermedia material 10 --- sticking --- it is equipped and the sealed cabins 15 and 15 applicable to the areole in the publication of a claim are formed in crevice 13b of the hollow convex objects 13 and 14, and 14b. Rigidity increases by formation of these sealed cabins 15 and 15, i.e., an airtight structure, and impact absorption and adiabatic efficiency increase. Furthermore, the epidermis material 91 and 91 sticks on the external surface of the attachment members 81 and 82, respectively, and is stuck to it.

[0019] The honeycomb structure plate 1 which the honeycomb structure plate 2 concerning the gestalt of the 2nd operation shown by drawing 2 (b) and the honeycomb structure plate 3 concerning the gestalt of the 3rd operation shown in this drawing (c) also require for the gestalt of said 1st operation, and fundamental structure are the same. Therefore, the same sign is given to the member which is common to the honeycomb structure plate 1, and explanation is omitted. In addition, with the gestalt of the 2nd operation, the hollow convex object 23 formed in sheet metal 21 is equivalent to one hollow convex object, and the hollow convex object 24 formed in

sheet metal 22 is equivalent to the hollow convex object of another side. Moreover, with the gestalt of the 3rd operation, the hollow convex object 33 formed in sheet metal 31 is equivalent to one hollow convex object, and the hollow convex object 34 formed in sheet metal 32 is equivalent to the hollow convex object of another side.

[0020] With the honeycomb structure plate 2 concerning the gestalt of the 2nd operation, the skin of each hollow convex objects 23 and 24 formed in each sheet metal 21 and 22 serves as bases 23c and 24c of these heights 23a and 24a contact, and this skin serves as Heights 23a and 24a. And the nothing in a truncated-cone configuration, and the pars intermedia material 20 is formed by fixing. On the other hand, the internal surface 23b and 24b of the hollow in which an end face carries out opening, i.e., crevices, is formed in the interior of each hollow convex objects 23 and 24. Furthermore, the attachment members 81 and 82 which have airtightness stick, and are stuck in order to plug up opening of Crevices 23b and 24b, and sealed cabins 15 and 15 are formed.

[0021] The honeycomb structure plate 3 concerning the gestalt of the 3rd operation serves as the configuration where the skin of the hollow convex objects 33 and 34 made the cylindrical bases 33c and 34c the convex spherical surface, and this skin serves as Heights 33a and 34a. And the pars intermedia material 30 is formed by making these heights 33a and 34a contact, and making them fix by one point. On the other hand, Crevices 33b and 34b are formed, the attachment members 81 and 82 which have airtightness are stuck and stuck to the interior of each hollow convex objects 33 and 34, and sealed cabins 15 and 15 are formed in it in order to plug up opening of these crevices 33b and 34b.

[0022] In the above, the gestalt of the 3rd operation mainly explained the mode from which the configuration of a hollow convex object differs from the 1st. However, if it is not limited to the gestalt of said the operation of each, and the heights of each hollow convex object formed in two or more sheet metal contact, consequently desired areole (sealed cabin) are formed among said two or more sheet metal, it is sufficient for this invention. Therefore, the configurations of a hollow convex object may be other configurations, for example, a semicircle ball and a prism configuration. Moreover, like the gestalt of said the operation of each, the location of each hollow convex object formed in two or more sheet metal corresponded each other correctly, for example, may be shifted to right and left a little. Incidentally, the two-dot chain line of drawing 2 (b) and (c) shows the condition of the hollow convex objects 23 and 24 and the hollow convex objects 33 and 34 shifting, and contacting each other.

[0023] Drawing 3 is a honeycomb structure plate concerning the gestalt of the 4th operation, (a) is drawing of longitudinal section and (b) is the X-X sectional view of (a). The honeycomb structure plate 4 concerning the gestalt of the 4th operation is the mode which embodied two or more concepts that it could set to this invention. Then, each concept in this invention is met and the gestalt of this operation is explained in full detail. In addition, about the same structure and a member, the same sign is substantially attached with the gestalt of said 1st operation etc., and detail explanation is omitted.

[0024] It is the configuration which the pars intermedia material 40 in the honeycomb structure plate 4 also made each sheet metal 41 and 42 contact mutually, fixed, and made it one. Moreover, the heights 43a and 44a of each hollow convex objects 43 and 44 formed in each of this sheet metal 41 and 42 serve as a truncated-cone configuration like the gestalt of said 2nd operation. Furthermore, two or more sub hollow convex objects 9 and .. other than the hollow convex object 43 are formed in one sheet metal 41 of this honeycomb structure plate 4. It is arranged between the hollow convex object 43 with which this sub hollow convex object 9 and .. adjoin each other, and .. (refer to drawing 3 R> 3 (b)), and base 9a is turned to sheet metal 42, and it is set up. That is, with the gestalt of this operation, the hollow convex object 43, the .. and sub hollow convex object 9, and .. are equivalent to one hollow convex object, and the hollow convex object 44 and .. are equivalent to the hollow convex object of another side. And only one hollow convex objects 43, ... 9, the hollow convex object 44 of another side, and .. are in contact with the hollow convex object 43 which is a part of ... and ..

[0025] Therefore, when an impact joins the honeycomb structure plate 4, the hollow convex objects 43, ... 44 and .. which contact each other first deform, and impulse force is absorbed. If

this deformation progresses, the sub hollow convex object 9, base 9a of .. and .. will interfere in sheet metal 42, and rigidity and impact absorptivity will be raised. That is, forming the hollow convex object 43, the .. and sub hollow convex object 9, and .., and making only the hollow convex object 43 which is the part, the hollow convex object 44 of .. and another side, and .. contact is the mode which embodied the 1st concept.

[0026] In addition, all of two or more sub hollow convex objects 9 concerning the gestalt of this operation and .. make the same configuration. Therefore, if it explains taking the case of one of them, the appearance configuration of the sub centrum material 9 differs the shape of a cylindrical shape from the configuration of nothing and the hollow convex object 43. Especially the diameter L3 of the sub hollow convex object 9 is a minor diameter as compared with the base diameter L1 in heights 43a of the hollow convex object 43, and it is arranged in order to fill the clearance between the adjacent hollow convex object 43 and 43 comrades. Consequently, generating of useless space can be mitigated and efficient rigid strengthening can be attained.

[0027] The hollow convex objects 43 and 44 concerning the gestalt of this operation already explained that it was a truncated-cone configuration. However, with the gestalt of this operation, the dimensions of each hollow convex objects 43 and 44 differ. Specifically, the base diameter L1 of heights 43a (on [ in drawing 3 (a) ]) in one hollow convex object 43 serves as size as compared with the base diameter L2 of heights 44a (under [ in drawing 3 (a) ]) in the hollow convex object 44 of another side. That is, that the dimension of one hollow convex object 43 differs from the hollow convex object 44 of another side is the mode which embodied the 2nd concept. That is, when the dimensions of one hollow convex object 43 and the hollow convex object 44 of another side differed like the gestalt of this operation and an impact joins the honeycomb structure plate 4, it becomes easy to transform one hollow convex object 43a or hollow convex object 44a, and an impact absorption effect increases.

[0028] Moreover, on the external surface of sheet metal 42, stick the attachment member 82 (refer to drawing 2 ), and it is not stuck to the honeycomb structure plate 4 concerning the gestalt of this operation. Instead, the external surface of sheet metal 42 is equipped with the epidermis material 92 which has permeability in the mode of sticking directly and sticking. If it is such a mode, the perfect sealed cabin 15 will not be formed in crevice 44b of the hollow convex object 44 formed in sheet metal 42. Consequently, the absorption-of-sound effectiveness by the side of sheet metal 42 improves. In addition, in crevice 43b of the hollow convex object 43 formed in sheet metal 41, the attachment member 81 sticks, and it sticks, and is alike, and a sealed cabin 15 is formed more. Therefore, rigidity is collateralized. That is, according to the gestalt of this operation, with the conventional honeycomb structure plate 100 (refer to drawing 10 ), while doing so the absorption-of-sound effectiveness which could not be accomplished, rigidity is also collateralized. As mentioned above, the structure of sticking the epidermis material 92 with permeability on one of sheet metal 41 and 42 directly, and sticking it to it is the mode which embodied the 3rd concept.

[0029] Drawing of longitudinal section of the honeycomb structure plate which drawing 4 (a) requires for the gestalt of the 5th operation, and (b) are drawings of longitudinal section of the honeycomb structure plate concerning the gestalt of the 6th operation. First, the honeycomb structure plate 5 concerning the gestalt of the 5th operation is explained in full detail. In addition, in the gestalt of this operation, and the gestalt of the 6th operation mentioned later, about the same structure and a member, the same sign is substantially attached with the gestalt of said 1st operation etc., and detail explanation is omitted.

[0030] With the honeycomb structure plate 5 concerning the gestalt of this operation, like drawing 4 (a), two or more formation of the hollow convex objects 53 and 54 which have the heights 53a and 54a of a truncated-cone configuration is carried out, and one hollow convex object 53 differs in a dimension from the hollow convex object 54 of another side further. moreover, two or more formation was carried out — on the other hand, the hollow convex object 53, .. and the hollow convex object 54 of another side, and .. some hollow convex objects 53, .. 54 and .. only comrades have contacted mutually. That is, with the gestalt of this operation, said sub hollow convex object 9 and .. (refer to drawing 3 ) are not formed, but the hollow convex object 53 and .. which do not participate in contact do so the same operation as the sub hollow

convex object 9 and .. By considering as such a mode, manufacture of the hollow convex object 53 and the sheet metal 51 which forms .. becomes easy. In addition, in drawing 4 (a), the sign 52 shows the sheet metal which forms the pars intermedia material 50 in contact with sheet metal 51.

[0031] The honeycomb structure plate 6 concerning the gestalt of the 6th operation is common in the gestalt of said 5th operation in fundamental structure. However, it is different like drawing 4 (b) in that the configurations of one hollow convex object 63 and the hollow convex object 64 of another side differ. The honeycomb structure plate 6 makes heights 63a in one hollow convex object 63 a truncated-cone configuration, and makes heights 64a in the hollow convex object 64 of another side the configuration which made the cylindrical base the convex spherical surface. That is, with the gestalt of this operation, the configuration of one hollow convex object 63 has embodied the concept of differing from the hollow convex object 64 of another side. In addition, in drawing 4 (b), it contacts mutually, and signs 61 and 62 show each sheet metal which forms the pars intermedia material 60.

[0032] According to the gestalt of this 6th operation, like explanation with the gestalt of said 4th operation, when an impact joins the honeycomb structure plate 6, it becomes easy to transform one hollow convex object 63a or hollow convex object 64a, and an impact absorption effect increases. In addition, the dimension and configuration of the combination of the concept drawn from the gestalt of this operation and the 2nd concept explained with the gestalt of said 4th operation, i.e., one hollow convex object, are changed with the dimension of the hollow convex object of another side, and a configuration, and an impact absorption effect can also be heightened.

[0033] In the above, the gestalt of the 6th operation mainly explained the mode from which the structure of pars intermedia material differs from the 4th. However, this invention is not limited to the gestalt of the 6th operation from this 4th [ the ]. That is, the configuration of the hollow convex objects 13, 14, 23, 24, 33, and 34 of the pars intermedia material 10, 20, and 30 illustrated with the gestalt of the 3rd operation from the 1st is also applicable to the gestalt of the 6th operation suitably from the 4th, respectively. It can be made the configuration explained with the gestalt of the 1st and the 3rd operation etc., and the configuration of a hollow convex object which specifically shows the configuration of the 4th and the hollow convex object shown with the gestalt of the 5th operation with the gestalt of the 6th operation can also be made into the configuration explained with the gestalt of the 1st and the 3rd operation etc.

[0034] Drawing 5 is drawing of longitudinal section of the honeycomb structure plate concerning the gestalt of the 7th operation. Although the honeycomb structure plate 7 concerning the gestalt of the 7th operation is explained below, about the same structure and a member, the same sign is substantially attached with the gestalt of said 1st operation, and detail explanation is omitted. The pars intermedia material 10 of the honeycomb structure plate 7 is the same pars intermedia material as the gestalt of the 1st operation make the heights of two or more sheet metal with which the hollow convex object of the shape of two or more cylindrical shape was located in a line come to contact mutually. The attachment member 81 which has airtightness should stick on one field of this pars intermedia material 10, stick, and be alike is equipped, the field of another side is equipped with the continuous glass fiber of a glass fiber, and the compound sheet 83 of plastics as stick, stick and be alike, and the epidermis material 91 is further stuck and stuck to compound sheet 83 external surface. Thereby, a sealed cabin 15 is formed in one field of pars intermedia material, and areole 15' which has permeability is formed in the field of another side. In addition, paper making of the compound sheet 83 is carried out by wet or dry type in the continuous glass fiber, plastics powder, and/or plastic fiber of a glass fiber which were judged by the diameter of 5 micrometers - 25 micrometers, and die length of about 5mm - several cm. Thus, by carrying out paper making, rigidity with the as expensive compound sheet 83 as permeability is given.

[0035] According to the gestalt of this 7th operation, when it fabricates to roof lining of an automobile etc., the smooth Plastic solid of a ridgeline can be acquired. This is explained in full detail based on drawing 6 (a) and (b). Drawing 6 (a) is the perspective view of the Plastic solid flexion at the time of fabricating the honeycomb structure plate 7 concerning the gestalt of the

7th operation to roof lining of an automobile etc., and (b) is the perspective view of the Plastic solid flexion at the time of fabricating the conventional structural panel to roof lining of an automobile etc. When roof lining of an automobile etc. was fabricated with the conventional structural panel 100, since the attachment member 103 and the epidermis material 105 were crooked along with the cylinder of pars intermedia material in the flexion, like drawing 6 (b), the ridgeline 115 became zigzag-like and had spoiled the appearance. On the other hand, with the honeycomb structure plate 7, since the rigidity in the heat period of the compound sheet 83 is high, the compound sheet 83 and the epidermis material 91 can be crooked without being influenced of a cylinder 14, and can obtain the mold goods of a smooth ridgeline like drawing 6 (a). Moreover, since the compound sheet 83 and the epidermis material 91 have permeability, the absorption-of-sound effectiveness from the field by the side of areole 15' which has permeability increases. Furthermore, compared with the conventional structural panel, the dimension of the honeycomb structure plate 7 is stable with existence of a glass fiber, and it has the description that scattering by destruction can be strongly prevented against an impact. Moreover, since rigidity is high and strong against an impact, the compound sheet 83 does not constitute a sealed cabin, but \*\* can also secure the rigidity of a honeycomb structure plate, shock resistance, etc., and can carry out the thinning of the roof lining rather, and can also take large space in the car.

[0036] In the above, the mode from which the quality of the material of an attachment member differs with the gestalt of the 7th operation was explained. However, this invention is not limited to the gestalt of said 7th operation. that is, the pars intermedia material 20 and 30 illustrated with the gestalt of the 6th operation from the 2nd and .. \*\*\* application of 60 can also be carried out at the gestalt of the 7th operation. For example, it is a case so that it may replace with the attachment members 81 and 82 of the pars intermedia material in the gestalt of the 3rd operation from the 1st and the compound sheets 83 and 83 may be used like drawing 7 and drawing 8. In addition, it is the perspective view of honeycomb structure plate 7a which replaced drawing 7 with the attachment members 81 and 82 of the gestalt of the 1st operation, and used the compound sheets 83 and 83, and the condition that (a) made the sheet metal of pars intermedia material estrange, and (b) are in the condition which the sheet metal of pars intermedia material was made to contact. Drawing 8 (a) is the Y-Y sectional view of honeycomb structure plate 7a, and replaces drawing 8 (b) with the attachment members 81 and 82 of the gestalt of the 2nd operation. It is drawing equivalent to the Y-Y sectional view of honeycomb structure plate 7b which used the compound sheets 83 and 83, and drawing 8 (c) is drawing equivalent to the Y-Y sectional view of honeycomb structure plate 7c which replaced with the attachment members 81 and 82 of the gestalt of the 3rd operation, and used the compound sheets 83 and 83. Moreover, if it aims at smoothing a ridgeline, not only an epidermis material adhesion side but both sides may be equipped with the compound sheet 83 that what is necessary is just to prepare for the epidermis material adhesion side at least. Moreover, the compound sheet 83 can also be considered as the configuration which does not prepare a preparation and the attachment member of the opposite side only in an epidermis material adhesion side. On the other hand, if it aims at the scattering prevention by destruction, with the epidermis material adhesion side, only the opposite side may be equipped with the compound sheet 83 that what is necessary is just to prepare at least for one side of pars intermedia material. Moreover, although the continuous glass fiber of a glass fiber was used as reinforcing materials of the compound sheet 83 with the gestalt of the 7th operation, if the reinforcement of the attachment member 81 and rigidity are raised, a carbon fiber, a metal fiber, etc. can also be used.

[0037] In the above, based on the gestalt of the 7th operation etc., the structure of each honeycomb structure plates 1, 2, 3, 4, 5, 6, and 7 was explained from the 1st. Next, the manufacture approach is explained to an example for the honeycomb structure plate 2 concerning the gestalt of the 2nd operation. Incidentally, shaping is easy for the sheet metal 21 and 22 of the honeycomb structure plate 2 explained here, and uses the polypropylene which is easy to perform welding etc. for it. Moreover, so much, although the polypropylene which is easy to perform welding etc. is used also for the attachment members 81 and 82, since a moldability is

not required, it uses playback polypropylene with cheap cost for these attachment members 81 and 82. In addition, as for the plastics powder and plastic fiber of the attachment member 81 and the compound sheet 83, consisting of the same ingredient is desirable. Moreover, resin material, an insulator, etc. are used for the epidermis material 91.

[0038] Drawing 9 is the mimetic diagram showing an operation of the vacuum-forming equipment which manufactures a honeycomb structure plate. With the vacuum-forming equipment M shown by drawing 9, opposite arrangement of the roll section M1 into which sheet metal 21 is sent, and the roll section M2 into which sheet metal 22 is sent is carried out. The mold section which forms the hollow convex objects 23 and 24, respectively is formed in each of these roll sections M1 and M2. And if sheet metal 21 and sheet metal 22 are sent into each rotating roll sections M1 and M2, heating and suction will be performed and the hollow convex objects 23 and 24 will be formed in sheet metal 21 and sheet metal 22.

[0039] Incidentally, the hollow convex objects 23 and 24 manufactured with this vacuum-forming equipment M are truncated-cone configurations. Therefore, it becomes [ the hollow convex objects 23 and 24 ] easy to fall out from the mold section of the roll sections M1 and M2 and is suitable when, fabricating the hollow convex objects 23 and 24 continuously like this example of manufacture for example. However, especially when continuous manufacture is not needed (for example, when forming with the mold estranged in the vertical direction), it is not necessary to consider as a truncated-cone configuration.

[0040] The formation location of the mold section formed in each roll sections M1 and M2 is sent out, where it corresponded each other, and the bases 23c and 24c of the hollow convex objects 23 and 24 contacted with rotation of each roll sections M1 and M2 and welding etc. is carried out (refer to the arrow head in drawing 9 ). That is, the pars intermedia material 20 is formed of this contact, welding, etc.

[0041] Further, on the pars intermedia material 20, the attachment member 81, the epidermis material 91, and the attachment member 82 and the epidermis material 91 stick, and is stuck, and the honeycomb structure plate 2 is completed to it. In addition, the member shown by M3 in drawing 9 -- a T die -- it is -- sending of sheet metal 21 and 22, the attachment member 81, and epidermis material 91 grade -- and -- sticking -- sticking -- etc. -- it acts.

[0042] In the above, the manufacture approach was explained to the example for the case where the honeycomb structure plate 2 is manufactured with a vacuum forming. However, this invention is not limited to the honeycomb structure plate 2 manufactured by this manufacture approach. That is, if it is when the quality of the material is thermoplastics or its constituent, you may be the honeycomb structure plate manufactured in the honeycomb structure plate manufactured by other manufacture approaches, for example, injection molding, blow molding, etc. Moreover, a honeycomb structure plate can also be manufactured with the quality of the materials, such as pulp, steel, stainless steel, aluminum or an aluminium alloy, and FRP.

[0043] Furthermore, in formation of pars intermedia material, if the hollow convex object which contacts each other does not need to fix through means, such as welding and adhesion, and can maintain a contact condition with other means, fixing etc. is unnecessary. For example, the sheet metal of two sheets which forms a hollow convex object is surrounded by superposition, and a perimeter is surrounded with a frame etc., and it inserts and can also consider as the mode to fix.

[0044] On the other hand, the use mode of a honeycomb structure plate can also use interiors, such as interiors, such as a car, and a house, etc. widely. However, when using for interiors, such as a car, it is suitable especially from the following reasons. That is, if the rigidity of a honeycomb structure plate is high when using it for roof lining of a car etc., the installation part to the part, a car body, etc. will decrease, and workability will improve. Moreover, when impact absorptivity increases, the damage at the time of a car collision etc. can be suppressed to the minimum, and safety increases. Furthermore, when using it for the interior of a car, as compared with a mere building material, there is much constraint to the AUW of a honeycomb structure plate, and needs, such as rigidity, impact absorptivity, and the absorption-of-sound effectiveness, also have it. [ high ] Therefore, when using it for interiors, such as a car, it can be said especially that it is suitable.

[0045]

[Effect of the Invention] According to this invention, rigidity, impact absorptivity, a heat insulation operation, etc. can be raised, without making the weight of a honeycomb structure plate increase. Moreover, in invention concerning claim 2, only when other hollow convex objects deform the hollow convex object which does not participate in contact, it will interfere, and effective strengthening of much more lightweight-izing and rigidity, and impact absorptivity can be attained. Moreover, according to invention concerning claim 3, the dimensions of the hollow convex object of one side and another side etc. differ, and it can expect to make deformation of a hollow convex object easy. Therefore, said effectiveness is accompanied and an impact absorption effect is heightened. Moreover, it is equipped with the epidermis material to which one field of pars intermedia material is equipped with an attachment member, a sealed cabin is formed, and invention concerning claim 4 has permeability in the field of another side. Therefore, the absorption-of-sound effectiveness from the field of this another side increases.

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[Translation done.]



## \* NOTICES \*

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1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

## DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the perspective view of the honeycomb structure plate concerning the gestalt of the 1st operation, and the condition that (a) made the sheet metal of pars intermedia material estrange, and (b) are in the condition which the sheet metal of pars intermedia material was made to contact.

[Drawing 2] It is the gestalt of the 3rd operation corresponding to the W-W sectional view of drawing 1 (b) in the gestalt of the 2nd operation, and (c) corresponding to the W-W sectional view of drawing 1 (b) in (b) corresponding to the W-W sectional view of drawing 1 (b) in (a).

[Drawing 3] It is a honeycomb structure plate concerning the gestalt of the 4th operation, and (a) is drawing of longitudinal section and (b) is the X-X sectional view of (a).

[Drawing 4] Drawing of longitudinal section of the honeycomb structure plate which drawing 4 (a) requires for the gestalt of the 5th operation, and (b) are drawings of longitudinal section of the honeycomb structure plate concerning the gestalt of the 6th operation.

[Drawing 5] It is drawing of longitudinal section of the honeycomb structure plate concerning the gestalt of the 7th operation.

[Drawing 6] Drawing 6 (a) is the perspective view of the Plastic solid flexion at the time of fabricating roof lining etc. with the conventional structural panel, and (b) is the perspective view of the Plastic solid flexion at the time of fabricating roof lining etc. with the honeycomb structure plate concerning the gestalt of the 7th operation.

[Drawing 7] It is the perspective view of honeycomb structure plate 7a which replaced drawing 7 with the attachment members 81 and 82 of the gestalt of the 1st operation, and used the compound sheets 83 and 83, and the condition that (a) made the sheet metal of pars intermedia material estrange, and (b) are in the condition which the sheet metal of pars intermedia material was made to contact.

[Drawing 8] Drawing 8 (a) is the Y-Y sectional view of honeycomb structure plate 7a, (b) is drawing equivalent to the Y-Y sectional view of honeycomb structure plate 7b, and drawing 8 (c) is drawing equivalent to the Y-Y sectional view of honeycomb structure plate 7c.

[Drawing 9] It is the mimetic diagram showing an operation of the vacuum-forming equipment which manufactures a honeycomb structure plate.

[Drawing 10] It is the perspective view of the conventional honeycomb structure plate, and (a) shows assembly before and (b) shows the assembly back.

[Drawing 11] It is the Z-Z sectional view of drawing 10 (b).

[Drawing 12] It is the mimetic diagram of conventional vacuum-forming equipment.

[Description of Notations]

1. 2. 3. 4. 5. 6. 7. Honeycomb structure plate

10. 20. 30. 40. 50. 60. Pars intermedia material

11. 21. 31. 41. 51. 61. Sheet metal

12. 22. 32. 42. 52. 62. Sheet metal

13. 23. 33. 43. 53. 63. One hollow convex object (hollow convex object)

13a. 23a. 33a. 43a. 53a. 63a. Heights

14. 24. 34. 44. 54. 64. The hollow convex object of another side (hollow convex object)

14a, 24a, 34a, 44a, 54a, 64a: Heights  
15: Sealed cabin  
15': Areole which have permeability  
91: Epidermis material  
92: Epidermis material (epidermis material which has permeability)

[Translation done.]